(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 167 623 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.01.2002 Bulletin 2002/01

(51) Int Cl.[7]: **D21F 7/08**

(21) Application number: **01305534.8**

(22) Date of filing: **26.06.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **27.06.2000 JP 2000193473**

(71) Applicant: **ICHIKAWA CO.,LTD.**
Tokyo (JP)

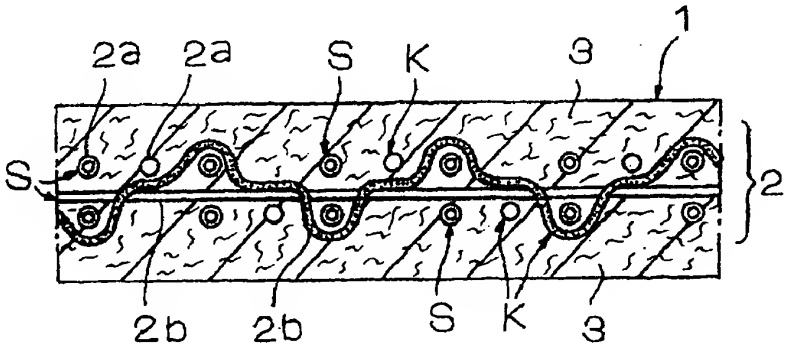
(72) Inventor: **Kobayashi, Yasuhiko**
Kashiwa-shi, Chiba-ken (JP)

(74) Representative: **Meddle, Alan Leonard et al**
Forrester & Boehmert Pettenkoferstrasse 20-22
80336 München (DE)

(54) Papermaking felt

(57) A papermaking felt comprises a woven ground fabric layer and a fibrous web accumulated on one side or on both sides of the ground fabric layer. The ground fabric and the fibrous web are intertwined and made integral by needling. To maintain the three dimensional structure of the felt against the pressure to which the papermaking felt is continually subjected in a high speed papermaking machine, and thereby retain the felt's water-squeezing function over a long period of time, all yarns of the warp or weft, or a part of the distributed yarns of the warp or weft which composes the ground fabric layer, are replaced by straight yarns S so that the warp or weft themselves maintain the felt's dimensional stability. Alternatively, straight yarns may be additionally and evenly inserted along the warp or weft of the ground fabric layer.

FIG.1a

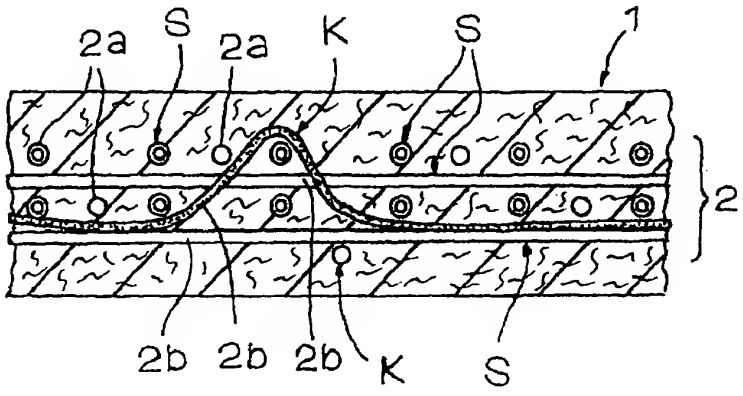


EP 1 167 623 A1

Printed by Jouve, 75001 PARIS (FR)

(Cont. next page)

FIG.1b



Description

FIELD OF THE INVENTION

[0001] This invention relates to a papermaking felt used for squeezing water from a paper web in a papermaking operation. The invention relates particularly to a papermaking felt having decreased dimensional changes in the MD and CMD directions when in use. The term "MD" refers to the direction in which the papermaking felt runs. "CMD" refers to a direction orthogonal to the MD direction.

BACKGROUND OF THE INVENTION

[0002] There has been a demand for felts having more efficiency in squeezing moisture from a wet web in the papermaking processes. It is also important that the felt retain its water-squeezing capability for a long time following its initial use. The reason for these requirements is that the felt is subjected to repeated compression in a papermaking machine, and consequently, the water-squeezing function gradually deteriorates. Thus, the felt must be replaced eventually by a new felt. While it is desirable to prolong the useful life of the felt, it is also important to maintain adequate water-squeezing capability in the felt before its replacement. Maintenance of stability in operation is one of the most sought-after properties in a papermaking felt.

[0003] The felt is adapted to pass through the pressing stages of the machine to effect drainage of water from the paper web. It must also pass through the pressing stage of a cleaning apparatus. Each time it passes through a pressing stage, the felt is subjected to compression. However, in spite of the stresses imparted to the felt by the pressing stages, it is necessary to retain the resilient character of the felt in order to maintain its water permeability.

[0004] With the recent introduction of high speed papermaking machines, the time span from the passage of the felt through a first pressing stage in the machine to a next pressing stage has become relatively short (approximately one second). As a result, the time allowed for restoration of the felt to its three dimensional structure as a result of its own resiliency has become very short. The nip pressure at the pressing stages has also increased. Because of the foregoing conditions, a dimensional change in the felt becomes inevitable, with the adverse effect that the felt loses its stability while running, and exhibits a deterioration in its water-squeezing capability within a few days, even though it is expected to have a service life of about 40 days.

[0005] The principal object of the invention is to solve the above-mentioned problem, and to offer a papermaking felt which can retain its three-dimensional character even in a high speed papermaking machine in which the felt is subjected to compression repeatedly in a short time period.

[0006] The papermaking felt in accordance with the invention comprises a ground fabric layer composed of a woven fabric, and a fibrous web placed on at least one side of the ground fabric layer, the ground fabric layer and fibrous web being integrally intertwined by needling, and the ground fabric layer having a warp and weft. In a first embodiment of the invention, in which the warp or weft of the ground fabric comprises distributed yarns, at least part of the distributed yarns of the warp or weft consists of straight yarns. Thus, the warp or weft itself, which composes the ground fabric layer is capable of maintaining high dimensional stability.

[0007] In a second embodiment, in which the ground fabric layer is composed of winding yarns, additional straight yarns are evenly inserted along the warp or weft of the ground fabric. High dimensional stability may be maintained through the additional straight yarns inserted along the warp or weft of the ground fabric layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

FIG. 1(a) is a schematic, enlarged, sectional view of an embodiment of a felt according to the invention, comprising a double weave ground fabric layer, in which a part of warp or weft is replaced by straight yarns;

FIG. 1(b) is a similar view showing another embodiment, in which the structure of the ground fabric layer is changed;

FIG. 2 is a schematic, enlarged, sectional view of a felt according to the invention comprising a multiple weave ground fabric layer, in which a part of warp or weft is replaced by straight yarns;

FIG. 2(b) is a similar view showing another embodiment, in which the structure of the ground fabric layer is changed;

FIG. 3(a) is a schematic, enlarged, sectional view of another embodiment of a felt according to the invention, comprising a woven ground fabric layer wherein straight yarns are added to the warp or weft; and

FIG. 3(b) is a similar view showing another embodiment, in which the structure of the ground fabric layer is changed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] Briefly, in FIGs. 1(a) and 1(b), the ground fabric layer of the felt is a woven fabric of double weave construction, and a part of the warp or weft is composed of straight yarns. Likewise, in the multiple weave construction illustrated in FIGS. 2(a) and 2(b), a part of the warp or weft consists of straight yarns. In FIGS. 3(a) and 3(b), straight yarns are added to the warp or weft of the ground fabric layer.

[0010] The felt 1 of the invention is composed of fibrous webs 3 accumulated on a ground fabric layer 2 which comprises a woven fabric. A fibrous web 3 may be placed on only one side of the ground fabric layer 2, or, alternatively, fibrous webs may be placed both on the top and on the bottom of the ground fabric layer. The fibrous web or webs are intertwined with the ground fabric layer by needling and are thereby made integral with the ground fabric layer. Markings generated by the needling process are not shown in the drawings.

[0011] Straight yarns S are used in the ground fabric layer 2 to maintain the three-dimensional structure of the ground fabric layer and thereby retain the water-squeezing function of the felt. There are two ways in which the straight yarns S may be used. One way is to replace a part of the distributed yarns of the warp 2a or weft 2b which compose the ground fabric layer 2 with straight yarns S, or to replace the whole of the warp 2a or weft 2b with straight yarns S. The remaining yarns are winding yarns K, as shown in FIGs. 1(a) and 1(b) and FIGs. 2(a) and 2(b). Another way to use the straight yarns S is to provide a ground fabric layer 2 composed of winding yarns K and to add straight yarns S, the straight yarns being evenly distributed along the warp 2a or weft 2b as illustrated in FIGs. 3(a) and 3(b). The term "evenly distributed" with reference to the distribution of the straight yarns S means that the straight yarns are arranged relative to the winding yarns K at a ratio of 1:1, 1:2 or 2:1, etc. In order to heighten the three-dimensional structure of the ground fabric layer 2, it is preferable that the ratio of the composition of the straight yarns S relative to the winding yarns K be at least 40%.

[0012] In case the straight yarns S are additional yarns, as shown in Figures 3(a) and (b), rather than replacements for some of the winding yarns K, they may be arranged along the warp 2a or weft 2b within the ground fabric layer 2, which otherwise consists of winding yarns K. It is also possible to bond a sheet-like assembly of straight yarns S to a ground fabric layer 2 comprising winding yarns K with a predetermined orientation by heat sealing (i.e., by lamination) or by an adhesive.

[0013] In the drawings, a circle within circle denotes a straight yarn in the warp direction, and a single circle denotes a winding yarn in the warp direction. A pair of parallel lines indicates a straight yarn in the weft direction, a pair of parallel lines with dots between them denotes a winding yarn in the weft direction.

[0014] In the ground fabric layer 2 shown in the drawings, straight yarns S are present in both the warp and weft directions. Therefore, dimensional stability is obtained in both directions, that is, in the MD direction as well as in the CMD direction. But, needless to say, similar dimensional stability is obtainable even if the straight yarns are used only in one direction, that is, only in the warp direction or only in the weft direction. For instance, the modulus in the weft direction is improved when straight yarns S are inserted in the ground fabric layer 2 in the weft direction, with a resultant smaller size reduction occurring as a result of the heat setting during manufacture. The straight yarns S suppress the increase in width and reduction of thickness that occur during use, resulting in a stable dimension in the sideward direction.

[0015] When the ground fabric layer 2 is composed of a weft double or a weft triple weave, the straight yarns S are inserted in the warp direction and when the ground fabric layer 2 is composed of a warp double or warp triple weave, the straight yarns S are inserted in the weft direction. It has been confirmed that the product so produced is dimensionally stable in both the warp and weft directions in use. This felt construction is particularly useful for improving the dimensional stability of papermaking felts used in recently introduced high speed papermaking machines.

[0016] The "straight yarn" S includes a yarn which is inherently straight, such as PET (polyethylene terephthalate) monofilaments. "Straight yarn" also includes those yarns which are "straight" in relation to the winding yarns K. For instance, when the winding yarns K are elastic, flexible yarns, such as nylons, then the less flexible monofilaments or multifilaments of PBT, PPS, nylon 610, nylon 612, nylon 12, semi-aromatic nylon (MXD6), or aramid are selected as the straight yarns. Also, the straight yarns are not necessarily limited to those intended to be straight, but include those yarns which become nearly straight as result of the fabric structure formation, because "straightness" may be determined relatively as mentioned above.

[0017] The "winding" yarn K means the yarn which plays the role of anchoring, or undulating up and down relative to the straight yarns S in the cases of FIGs. 1(a), 1(b), 2(a) and 2(b). And, in case of FIGs. 3(a) and 3(b), the winding yarn K is the essential yarn which composes the ground fabric structure.

[0018] To summarize the advantages of the invention, as mentioned above, the invention is a paper-making felt comprising a ground fabric layer of a woven fabric and a fibrous web placed on at least one side of said ground fabric layer, the ground fabric layer and fibrous web being intertwined and made integral by needling.

[0019] According to one aspect of the invention, the felt is characterized in that all yarns of either the warp or weft forming the ground fabric layer are straight yarns, or a part of the distributed yarns of the warp or weft are straight yarns. Owing to the dimensional stability of the straight yarns of the warp or weft comprising the ground fabric layer, the modulus in the direction of the inserted straight yarns is improved. Consequently, the width decrease that occurs in the heat-setting stage of the manufacturing process decreases, and the increase in width and decrease in thickness during use of the felt in a papermaking machine are suppressed. Thus, the invention contributes to the stability of the felt, while running in the papermaking machine, with decreased elongation in the longitudinal and sideward directions. The papermaking felt of the invention is capable of satisfactorily

performing its desired function as a papermaking felt for a longer time, which is a highly desirable and advantageous effect.

[0020] According to another aspect of the invention, the papermaking felt is characterized in that the ground fabric layer is composed of winding yarns, and straight yarns are additionally and evenly inserted along the warp or weft of the ground fabric yarn. Because the ground fabric layer may be reinforced with straight yarns, the dimensional stability of the ground fabric layer may be obtained relatively easily, which is also a highly desirable and advantageous effect.

Claims

1. A papermaking felt comprising a ground fabric layer composed of a woven fabric, and a fibrous web placed on at least one side of the ground fabric layer, the ground fabric layer and fibrous web being integrally intertwined by needling, and the ground fabric layer having a warp and weft, each comprising distributed yarns, wherein at least part of the distributed yarns of the warp or weft of the ground fabric layer consists of straight yarns.

2. A papermaking felt comprising a ground fabric layer composed of a woven fabric, and a fibrous web placed on at least one side of the ground fabric layer, the ground fabric layer and fibrous web being integrally intertwined by needling, and the ground fabric layer having a warp and weft, wherein the ground fabric layer is composed of winding yarns, and includes additional straight yarns evenly inserted along its warp or weft.

FIG.1a

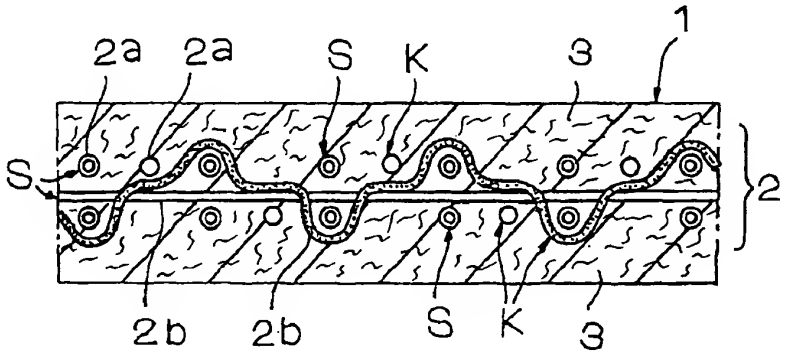


FIG.1b

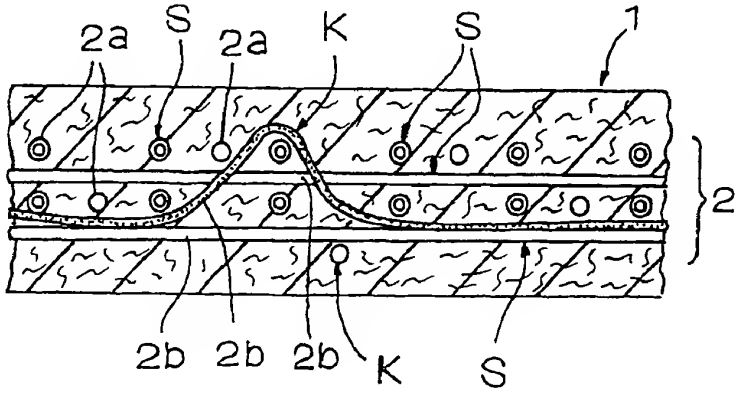


FIG.2a

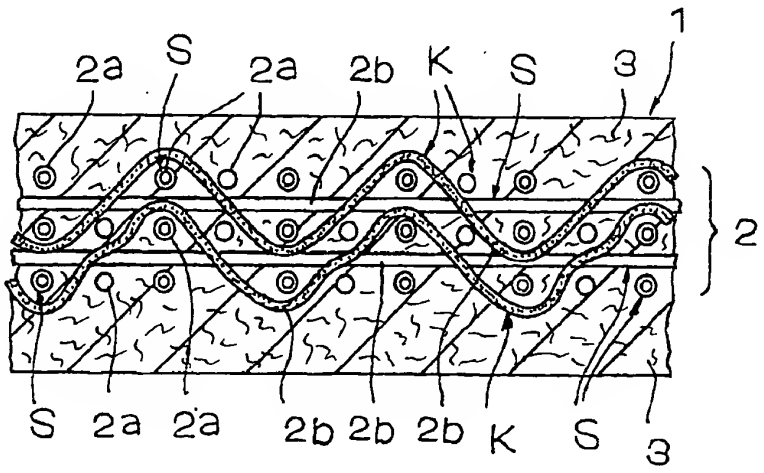


FIG.2b

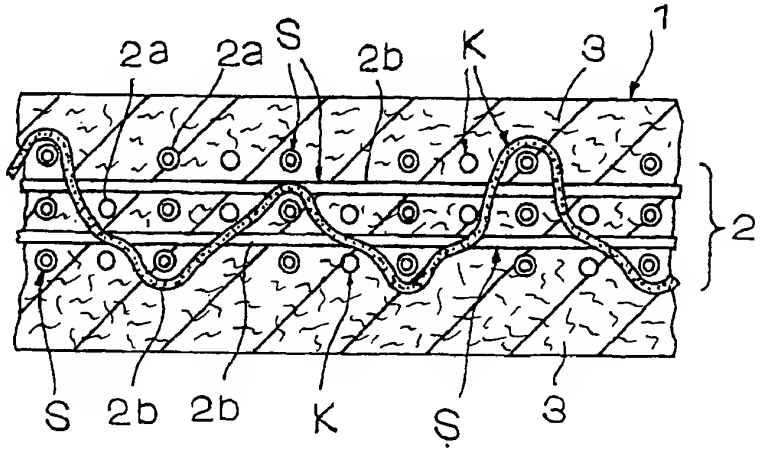


FIG.3a

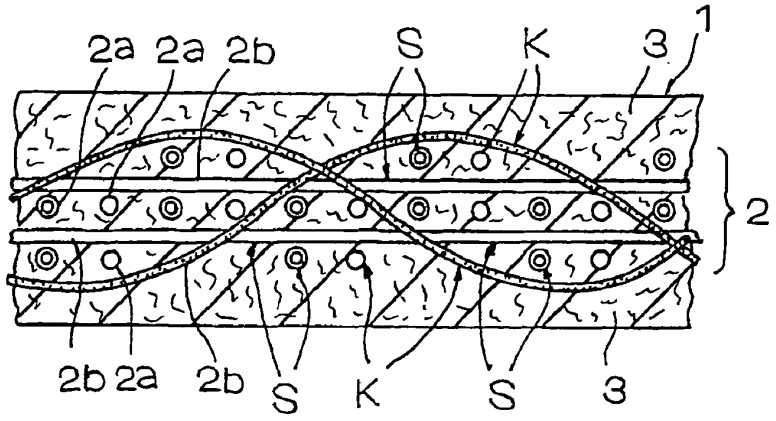
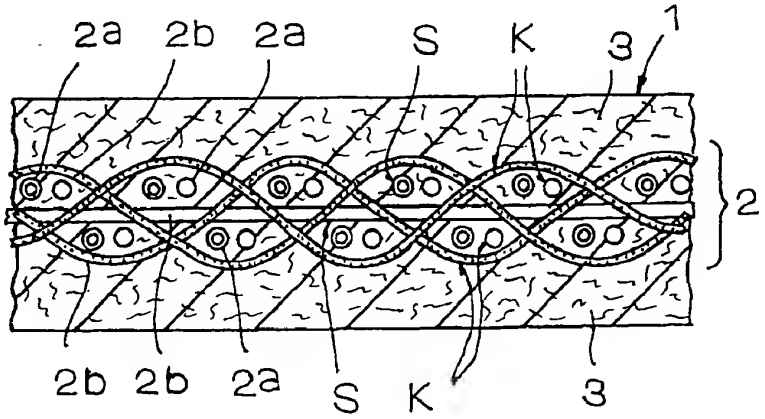


FIG.3b



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 30 5534

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 612 882 A (ASTEN GROUP, INC.) 31 August 1994 (1994-08-31) * column 10, line 41-55 *	1	D21F7/08
X	US 5 657 797 A (TOWNLEY ET AL) 19 August 1997 (1997-08-19) * the whole document *	2	
X	US 4 187 618 A (DIEHL) 12 February 1980 (1980-02-12) * the whole document *	2	
A	FR 2 020 058 A (NORDISKA MASKINFILT AB) 10 July 1970 (1970-07-10) * the whole document *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 October 2001	De Rijck, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 30 5534

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-10-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 612882 A	31-08-1994	US 5103874 A	14-04-1992
		US 5092373 A	03-03-1992
		US 5117865 A	02-06-1992
		EP 0553501 A2	04-08-1993
		EP 0612881 A1	31-08-1994
		EP 0612882 A1	31-08-1994
		AT 114006 T	15-11-1994
		AT 172764 T	15-11-1998
		AT 154403 T	15-06-1997
		AT 172506 T	15-11-1998
		AU 649570 B2	26-05-1994
		AU 2703092 A	07-01-1993
		AU 673613 B2	14-11-1996
		AU 7039394 A	03-11-1994
		AU 673615 B2	14-11-1996
		AU 7039494 A	03-11-1994
		AU 642004 B2	07-10-1993
		AU 7553891 A	31-12-1991
		CA 2084054 A1	07-12-1991
		CA 2174001 A1	07-12-1991
		CA 2174002 A1	07-12-1991
		CA 2174003 A1	07-12-1991
		DE 69105130 D1	15-12-1994
		DE 69105130 T2	23-03-1995
		DE 69126545 D1	17-07-1997
		DE 69126545 T2	18-12-1997
		DE 69130398 D1	26-11-1998
		DE 69130398 T2	11-03-1999
		DE 69130423 D1	03-12-1998
		DE 69130423 T2	22-04-1999
		DE 553501 T1	12-03-1998
		DE 612882 T1	12-03-1998
		DK 532510 T3	24-04-1995
		DK 553501 T3	05-07-1999
		DK 612881 T3	14-07-1997
		DK 612882 T3	28-06-1999
		EP 0532510 A1	24-03-1993
		ES 2063504 T3	01-01-1995
		ES 2107977 T1	16-12-1997
		ES 2102711 T3	01-08-1997
		ES 2107978 T1	16-12-1997
		FI 925483 A ,B	02-12-1992
		FI 935012 A ,B	12-11-1993
		FI 935013 A ,B	12-11-1993
		FI 935014 A ,B	12-11-1993
		FI 935015 A ,B	12-11-1993

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 30 5534

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-10-2001

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 612882 A		JP 31797 B2	
US 5657797 A	19-08-1997	CA 2196231 A1	03-08-1997
US 4187618 A	12-02-1980	NONE	
FR 2020058 A	10-07-1970	SE 324700 B	08-06-1970
		DE 1948217 A1	27-05-1970
		FR 2020058 A5	10-07-1970
		GB 1290690 A	27-09-1972
		NL 6914604 A	09-04-1970
		US 3839136 A	01-10-1974

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82